



SELF-REGULATION AND LOCUS OF CONTROL AS PREDICTORS OF ACADEMIC ACHIEVEMENT OF PHYSICS EDUCATION STUDENTS IN ENUGU STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY.

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ABSTRACT

The dearth of studies on the predictive power of non-cognitive variables like academic self-regulation and locus of control as predictors of academic achievement of Physics students in the Department of Science Education, Enugu State University of Science and Technology, Enugu State, Nigeria necessitated the study. Three null hypotheses tested at .05 level of significance guided the study. An ex-post-facto research design was adopted for the study. Purposive sampling procedure was used in selecting 139 Physics Education students comprising 75 males and 64 females from Physics programme, Department of Science Education. Three instruments were used for data collections. Academic self-regulation scale was adapted from Akhatar and Mahmood (2013). Academic locus of control scale was adapted from Trice (1985) and Physics academic Achievement scores were extracted from the students' semester examination of 2020/2021 academic session, conducted by the university, (ESUT). The reliability of the instruments were tested using Cronbach's alpha which yielded indices of 0.87 and 0.76 respectively. Data were analyzed using multiple regression. The results indicated that academic self-regulation and locus of control relatively and jointly contributed significantly to the prediction of academic achievement of Physics Education students. There was no variation in relative and joint prediction of achievement in Physics based on gender. Based on the findings, it was recommended that lecturers should adopt teaching strategies that should stimulate Physics students' gender-friendly academic self-regulation and locus of control in order to increase students' achievement in Physics.

Keywords and Phrases: Academic self-regulation, locus of control, gender and Physics achievement.

INTRODUCTION

Science Education (SE) embodies all educational processes aimed at providing unlimited opportunities for learners to understand and utilize the necessary knowledge, skills and attitudes required to operate effectively in a scientific and technological society. SE is an integral field of study which considers the subject matter of Science disciplines such as Biology, Chemistry, Physics and Agriculture as well as the process involved in the teaching and learning of science (Okeke, 2014). It is in the attainment of this goal of SE



that humans hope to produce the required large pool of experts in SE, which will help to bring about the much-needed socio-economic development of a nation. These experts can only be produced through a well-organized and efficient science and technology education. Physics education is an aspect of Science Education that deals with the teaching and learning of physical properties of matter in relation to its energy.

Physics is the most fundamental and the root of every field of Science (Eryilmaz, 2016). Anyakoha (2016) defined Physics as a natural Science that involves the study of matter and energy and their interactions. Onah and Anamezie (2022) defined Physics as the science subject that studies matter, objects, energy and their interaction in a given system or environment. Physics is the study of the natural phenomenon at its most fundamental levels and manner (Onah, 2022). This is because, Physics, being one of the core subjects offered in Nigerian schools forms the basis for the nation's technological advancement and human resource development (Abubakar, 2012). Physics knowledge has contributed immensely to the production of artifacts of tremendous advantage to the human race (Sani, 2012). The knowledge of Physics according to Gabriel (2012) offers the learners the opportunity to think critically, reason analytically and acquire the spirit of enquiry. The researcher also stressed that the knowledge of Physics develops in students, the scientific and technological knowledge, skills and attitudes which will assist them to make decisions based on the observation and experimentation. Quantum Physics, Geophysics, Medical Physics, Computing Physics, Material Physics, Environmental Physics, Communication, Physics Education, Engineering and Industrial Physics, to list but a few, are career courses in institutions of higher learning. The knowledge of Physics leads to the emergence of technologically sophisticated materials like computers, transistors, laser and other Robotic machines that have made the world indeed a global village and a better place. (Onah & Achufusi, 2022).

As important as Physics Education is to national development of any nation, students' academic achievement has not been encouraging in the institutions of higher learning. The pass rate for the undergraduate Physics Education courses at Enugu State University of Science and Technology (ESUT) for the past couple of years has been dismal. For example, in 2020, the pass rates for SED 144 (Teaching Fluid Mechanics), SED 243 (Teaching Atomic Physics) and SED 346 (workshop practices in Physics Education) were 25%, 38% and 43% respectively, though in 2021, there were relative improvement of student's achievement in the courses aforementioned, as about 60% of the students who sat for the respective courses had at least a credit pass (C, 50-69 marks) (Department of Science Education, ESUT 2022). The low pass rates in all the Physics Education undergraduate courses have prompted the question regarding which cognitive and non-cognitive factors predict academic achievement in Physics Education. The Lecturers during results consideration stated that many students could not properly draw Physics diagrams, give correct definitions of some concepts or solve some problems, using mnemonics to master some Physics equations. It was also observed that many Physics Education students found it difficult to use mathematical theory developed from the



experimental variables to determine the values of unknown physical quantities, given some known physical quantities prior to experimentation. Also, a greater number of the students do not believe that they can do well in Physics examinations.

The diagnosis of the factors that could have contributed to Physics students' poor achievement in Physics Education courses, the cognitive factors appear to take the lead. The non-cognitive factors appear to be relegated to the background. The non-cognitive variables are also important determinants of achievement in Physics. They reflect the affective dimension of educational objectives. Both the cognitive, psychomotor and affective dimensions of educational objectives are important for any meaningful teaching and learning to take place. The undergraduate students' poor achievement in Physics Education has been attributed to non-cognitive student-level variables like academic self-regulation and academic locus of control. There is a dearth of studies on the predictive power of academic self-regulation and academic locus of control on achievement in Physics at the university level. This study therefore, is set to find out the predictive powers of students' academic self-regulation and locus of control on their academic achievement on Science Education.

Academic self-regulation is defined as the act of controlling one's behavior, emotions, thoughts, feelings and actions in the pursuit of long-term academic goals. Self-regulation is also seen as the act of setting specific goals which involves utilizing task strategies such as elaborating, organizing, rehearsing and displaying high levels of self-efficacy and intrinsic interest; self-monitoring and self-reflecting on performance outcomes. Academic self-regulation involves students who can be self-independent, self-initiated learners with the ability to use a variety of learning strategies to accomplish specific learning goals (Zimmerman, 2012). According to Zimmerman and Kitsantas (2014), self-regulation is a multidimensional construct that includes the regulation of emotion, cognition, and behavior for attainment of educational goals. Within the academic domain, self-regulation encompasses purposeful actions, monitored and sustained by the learner, to achieve learning goals. According to Younes, Sheida, Ali, Yusof, Omid, & Reza (2014), self-regulation is a skill that individuals employ to change their thoughts, feelings, desires, and daily activities to attain higher goals. They added that self-regulation includes strategies, which individuals use to regulate and control the academic cognition. Pintrich (2000) in Younes et al (2014) defined self-regulation as the active and constructive processes that learners employ to regulate, motivate and control their cognition and behavior for enhanced academic achievement. They opined that students who are self-regulated have certain features distinguishing them from students who are not. These features include using cognitive strategies, controlling and trying to arrange time, programming and controlling mind processes to reach personal goals, creating appropriate learning environments, putting in adequate effort to control and regulate academic assignments and class environment. Self-regulation is a learning factor which was introduced by Bandura in 1967. Bandura developed a social cognitive theory (SCT) of human behavior in 1976; which states that human behavior is extremely regulated and



motivated by the ongoing exercise of self-influence. Bandura describes self-regulation as the ability to begin and give up necessary activities, social and educational opportunities, and the ability to postpone achieving task or a desired goal (Bandura, 1988, 1991; Kitsantas, Winsler and Huie (2008). One theorist who had a great impact on the expansion of self-regulation was Zimmerman. Zimmerman describes self-regulation as self-regulation of thoughts, emotions and self-generated actions, which are planned and acquired periodically to achieve personal goals (Garner, 2009; Zimmerman, 2008; Zimmerman, Bonner, & Kovach, 1996). Based on literature, individuals have two systems of self-regulation: promotion self-regulatory focus and prevention self-regulatory focus. In promotion focus, the subject is sensitive to positive results, whereas in prevention focus the subject is sensitive to the absence of losses. The significance of self-regulation has been emphasized in all psychological aspects of Human behavior, not only in the emotional aspect (Tseng & Kang, 2009). The study is set to find the predictive contribution of students' self-regulation on their academic achievement in Physics Education. Locus of control has also been identified as one of the personal traits that have great influence on students' academic achievement.

Locus of control is defined as the individual's believe and perception that the cause(s) of main events or achievements in his/her life is solely controlled by his/her effort. Locus of control has also been identified as one of the personal traits that have great influence on students' academic achievement. According to Okonkwo (2012) students' future expectations and emotional reactions are influenced by their causal attributions which in turn affect their current achievement outcome. Locus of control refers to the site of a cause, that is, whether or not the outcome of an event is attributed to something inside (internal to) or outside (external to) the person involved. It relates to people's attitudes, emotions, health and motivation as well as behavior in organization and institutions. Locus of control form during childhood and stabilizes during adolescence; and it depends on the various experience the individual goes through including culture, religion, societal influence, sex, age and training (Inel & Turker, 2012). Individual develops a locus of control when reinforcement is perceived as contingent on his/her behavior. Behaviors that results in reinforcement serve to strengthen an individual's perception of control but when reinforcement fails to occur, the expectancy will diminish or extinguish (Bricelo, Gifford, Mianzo & Perriott, 2006). The social cognitive theory forms the theoretical foundation of this study. The theory posits that human behaviour is regulated by self influence. Both academic self-regulation and locus of control are types of human behaviours which are regulated by self will.

Students' locus of control determines significantly their academic readiness, willingness and achievement in any learning exposure. Prior to the study, the levels of the undergraduate students' self-regulation and locus of control were sought. The results of the preliminary study indicated that the undergraduate students showed low levels of academic self-regulation and locus of control. The researchers thought it necessary to measure the predictive powers of the variables on academic achievement. The general



desire to improve on non-cognitive learning skills and student's academic achievement in Physics Education should be a concern of all stakeholders in education in Nigeria. Therefore, this study seeks to examine the predictive power of students' academic self-regulation and locus of control on their academic achievement in Physics Education in Enugu State University of Science and Technology, Enugu State, Nigeria irrespective of gender.

Gender has been noted by researchers over the years as having impact on achievement in Physics and its related disciplines (Akumah, 2013). Akumah even stressed that science, technology and their related disciplines are male-reserved while Art and Humanities are female reserved. This belief makes boys appear to have a natural positive attitude towards science and technical subjects while girls show more inclination to Arts and Humanities. The problem is even compounded by the fact that most science educators give masculine outlook to science subjects such as Chemistry and Physics (Babajide, 2010) which encourages female students to opt for for Biology, Agricultural Science and Home Economics which they consider to be more female-friendly science subjects. Other researchers like (Nwankwo & Okoye, 2015; Orefor, 2016) opined that gender has no influence on students' achievement in the Science fields. Female students appear to have phobia for science and science-related subjects relative to the Arts, which may affect their future career-choice and eventual achievement in Science sub-disciplines. Due to lack of consensus regarding the issue of gender and Science achievement including Physics, there is need therefore to investigate the predictive powers of self-regulation and locus of control on the achievement of male and female students in the Physics Education.

PURPOSE OF THE STUDY

The purpose of the study is to measure the prediction of academic self-regulation and locus of control on the achievement of Physics Education students in Enugu State University of Science and Technology. Specifically, the study sought to find the:

1. Predictive index of Physics students' academic self-regulation on their academic achievement.
2. Predictive index of Physics students' locus of control on their academic achievement.
3. Joint predictive index of academic self-regulation and locus of control on students' academic achievement in Physics.
4. Moderating effect of gender on students' academic self-regulation in predicting their academic achievement in Physics.
5. Moderating effect of gender on students' locus of control in predicting their academic achievement in Physics.
6. Moderating effect of gender on combined academic self-regulation and locus of control in predicting academic achievement in Physics.



HYPOTHESES

The following null hypotheses ($P \leq 0.05$) were formulated for the study:

1. There is no significant contribution of students' academic self-regulation to the prediction of their academic achievement in Physics.
2. There is no significant contribution of students' locus of control to the prediction of their academic achievement in Physics.
3. The joint contributions of students' self-regulation and locus of control are insignificant to the prediction of their academic achievement in Physics.
4. The moderating effect of gender on students' self-regulation in predicting their academic achievement in Physics is insignificant.
5. The moderating effect of gender on students' locus of control in predicting their academic achievement in Physics is insignificant.
6. Moderating effect of gender on combined academic self-regulation and locus of control in predicting academic achievement in Physics is not significant.

METHOD

The study employed an ex-post-facto research design incorporating both the correlation and qualitative approaches to interpret the results of the test of null hypothesis. The ex-post facto research design was chosen because the independent and dependent variables were not manipulated (Orodho, 2012). The variables existed prior to the study. Orodho (2012) and Brooks (2013) contend that a major purpose of ex-post-facto research design of a correlation subtype is to clarify an understanding of important variables that have already occurred through the identification of relationships among the variables. The population of the study was 191 Physics Education students in Enugu State University of Science and Technology (ESUT). The sample for the study consisted of 139 students (75 male and 64 female). The sample was drawn using purposive sampling technique, because the study was restricted to Physics Education students. Simple random sampling, precisely balloting with replacement was used to select from 100 level to 400 level students in the Physics Education programme. The instrument used for data collection were three in number: the Physics academic self-regulation scale (PASRS) adapted from 30 items scale of Akhatar and Mahmood (2013), the researchers adapted the scale because five (5) items could not satisfy the confirmatory factor analysis test of construct validation. Therefore, the 5 items were dropped. Trice (1985) Physics academic locus of control scale (PALCS) was modified by researchers. The items were modified from secondary school students rating to suit undergraduate Physics Education students. Physics academic achievement scores were extracted from the undergraduate 2020/2021 students' examination. The examination was organized by Enugu State University of Science and Technology. The examination questions were normally taken through the basic processes of validation and reliability before they were administered. Hence, the examination questions were deemed fit, valid and reliable. The academic achievement raw scores were changed to 5-point ordinal scale by the researchers as follows: 1 (0 – 39marks = F or 40 – 44marks = E) through 3 (50 – 59 marks = C) to 5 (70 – 100marks = A).

The two instruments PASRS and PALCS were face validated by three experts and tested for internal consistency reliability using Cronbach's alpha which yielded coefficients of 0.87 and 0.76 respectively. The instruments were administered to the students by two research assistants. Hypotheses were tested using multiple linear regression analysis. If the p-value is less than .05, then the null hypothesis is rejected and accept alternative hypothesis but if the p-value is greater than .05, do not reject the null hypothesis.

The results were presented in tables according to the null hypotheses that guided the study. Table 1 displays the un-standardized coefficients with t- and p-values of each individual predictor and the moderator variables respectively. The table showed that each of the independent variables made a significant contribution to the prediction of academic achievement.

Coefficients ^a		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
Model		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	13.345	4.129		3.232	.002	5.180	21.511
	Academic self-regulation	.208	.060	.202	3.450	.001	.089	.327
	Locust of control	.631	.048	.727	13.245	.003	.536	.725
2	(Constant)	-12.821	13.386		-.958	.340	-39.298	13.656
	Academic self-regulation*locus of control	.508	.206	.493	2.461	.015	.100	.916
	Gender*Academic self-regulation	-.172	.129	-.577	-1.341	.182	-.427	.082
	Gender*Locus of control	-.059	.101	-.213	-.577	.565	-.259	.142
3	Gender*Locus of control*Academic self-regulation	.719	.143	.828	5.040	.104	.437	1.001

Model1: R=0.24, R²= t=3.37, p<0.05
Model2: R=0.24, R²= t=3.37, p>0.05
Model3: R=0.24, R²= t=3.37, p>0.05
a. Dependent Variable: Achievement in Physics



From Table 1, academic self-regulation had an un-standardized regression coefficient, $B = .208$ and standardized beta-coefficient or slope factor ($\beta = .202$) was significantly different from 0 ($t = 3.450$; $P = 0.001$). The result of the unstandardized regression coefficient shows that Physics achievement increases by .208 when the predictor variable (academic self-regulation) increases by one standard deviation, keeping other variables in the single-factor model (model1) constant. Since the significance value attached to t value of 3.45 is less than .05, it means that academic self-regulation is significantly different from zero. So, the first null hypothesis (H_{01}) which states that there is no significant contribution of students' academic self-regulation to the prediction of their academic achievement in Physics is rejected. This means that academic self regulation predicts achievement in Physics. For locus of control, the un-standardized coefficient ($B = .631$) and standardized coefficient ($\beta = .727$) were statistically significantly different from 0 ($t = 13.245$; $P = 0.003$). The result of the unstandardized regression coefficient shows that Physics achievement increases by .003 when the predictor variable (academic locus of control) increases by one standard deviation, keeping other variables in the model constant. Since the significance value attached to t value of 13.245 is less than .05, it means that academic locus of control is significantly different from zero. So, second null hypothesis (H_{02}) which states that there is no significant contribution of students' locus of control to the prediction of academic achievement in Physics is rejected. This means that academic locus of control predicts achievement in Physics. Thus, for every one standard deviation increase in the students' locus of control, the academic achievement in Physics increased by .003, keeping constant other variables in the single-factor model.

The interaction of academic self-regulation and locus of control to the prediction of Physics achievement has .508 as the value of unstandardized regression coefficient whereas the significance attached to t -value of 2.461 was .015. The result of the unstandardized regression coefficient shows that Physics achievement increases by .508 when the predictor variable (academic self-regulation and locus of control interaction) increases by one standard deviation, keeping other variables in a two-factor model (model2) constant. Since the significance value attached to t value of 2.461 is more than .05, it means that academic self-regulation and locus of control interaction is significantly not different from zero. So, the third null hypothesis (H_{03}) which states that the joint contributions of students' self-regulation and locus of control are insignificant to the prediction of their academic achievement in Physics is rejected. This means that academic self regulation and locus of control interaction does not predict achievement in Physics.

The interaction of gender and academic self-regulation has -.172 as the value of the unstandardized regression coefficient (model2) whereas the significance attached to t -value of -1.341 was .182. The result of the unstandardized regression coefficient shows that Physics achievement increases by -1.341 when the predictor variable (gender and academic self-regulation interaction) increases by one standard deviation, keeping other variables in a two-factor model constant. Since the significance value attached to t value of -1.341 is more than .05, it means that gender and academic self-regulation interaction is



significantly not different from zero. So, the fourth null hypothesis (H_{04}) which states that the moderating effect of gender on students' self-regulation in predicting their academic achievement in Physics is insignificant is rejected. This means that gender and academic self regulation interaction does not predict achievement in Physics. Students' gender is not sensitive to academic self regulation in predicting achievement in Physics.

Two-way interaction of gender and locus of control has -.059 as the value of the unstandardized regression coefficient (model2) whereas the significance attached to t-value of -.577 was 0.565. The result of the unstandardized regression coefficient shows that Physics achievement increases by -.059 when the predictor variable (gender and academic locus of control interaction) increases by one standard deviation, keeping other variables in a two-factor model constant. Since the significance value attached to t-value of -.577 is more than .05, it means that gender and academic locus of control interaction is significantly not different from zero. So, the fifth null hypothesis (H_{05}) which states that the moderating effect of gender on students' locus of control in predicting their academic achievement in Physics is insignificant is rejected. This means that gender and academic locus of control interaction does not predict achievement in Physics. Students' gender is not sensitive to academic locus of control in predicting achievement in Physics.

The 3-way interaction of gender academic self-regulation and locus of control has .719 as the value of the unstandardized regression coefficient (model3) whereas the significance attached to t-value of 5.040 was 0.104. The result of the unstandardized regression coefficient shows that Physics achievement increases by .719 when the predictor variable (gender, academic locus of control and academic self-regulation interaction) increases by one standard deviation, keeping other variables in a two-factor model constant. Since the significance value attached to t-value of 5.040 is more than .05, it means that the 3-way interaction of gender, academic locus of control and academic self-regulation is significantly different from zero. So, the sixth null hypothesis (H_{06}) which states that the moderating effect of gender on combined academic self-regulation and locus of control in predicting academic achievement in Physics is rejected. This means that gender, academic locus of control and academic self-regulation interaction does not predict achievement in Physics. Students' gender is not sensitive to academic locus of control and self-regulation interaction in predicting achievement in Physics.

DISCUSSION OF THE FINDINGS

The results of the study showed that: academic self-regulation made a significant contribution to academic achievement of Physics Education Students. The finding is consistent with the previous works of (Baris, 2015; Zimmerman, 2012; Zimmerman, 2011; Zimmerman, 2010; Stephanie, 2013; Kitsantas, Winsler & Huie, 2008, Zimmerman & Schunk, 2008). However, the result is in disagreement to the result of earlier study by Achufusi and Utaka, 2021. This was also consistent with Bandura (1967) who noted that those who have a sense of self-regulation in mastering academic task tend to learn better in formal school environment as well as in an informal environment outside the school.



The result of this study tends to strengthen the theoretical foundation of this study. The social cognitive theory which is the theoretical foundation of this study is hinged on selfwill as a determinant of human behavior. Academic self regulation is a factor of selfwill, whereas Physics achievement is a factor of human behaviour. The result of the study has actually validated the authenticity of the social cognitive theory. Also, the result of the study which shows that a positive relationship exists between academic self regulation and achievement in Physics appears have been caused by an extant factor of good and exemplary leadership of the present vice-chancellor of Enugu State University of Science and Technology, Prof Aloysius-Michaels Okolie who adopts zero-tolerance to corruption. The Physics Education students' academic self-regulation and achievement in Physics may have increased as a result of a latent factor-good administration.

The locus of control predicted academic achievement in Physics. The finding is consistent with the previous work of (Ugwuanyi and Achufusi, 2021, Adedeji, Adeniyi & Adeyinka, 2011). Moreover, other authors reported that locus of control did not predict achievement in Physics in their studies (Akomolafe & Ogunmakin, 2013). This means that students who are not achieving well academically are more likely to be easily contented with just minimal success and achievement. It also implies that the achievement of a student in classroom activities is linked to the use of locus of control to enhance his/ her achievement.

The result also showed that self-regulation and locus of control jointly predicted Physics Education students' academic achievement. The finding is consistent with the findings of Ugwuanyi and Achufusi (2021), who observed that two independent variable significantly predicted academic achievement in Physics.

On the issue of gender, the result of the study showed that the interaction of gender and academic self-regulation did not vary across male and female sub-samples in the prediction of Physics achievement. Gender was not found to be a significant factor in the prediction of Physics achievement. This result conflicts with earlier report by Akumah, 2013 who noted that prediction of Physics was in favour of male students. This result is in tandem with earlier results of Nwankwo and Okoye, (2015)'and Orefor, (2016) in their independent studies. Also, gender interaction with locus of control was not a significant factor in predicting Physics achievement. The three-way interaction of gender, academic self-regulation and locus of control predicted Physics achievement.

CONCLUSION AND RECOMMENDATIONS

The result had so far revealed that the independent variables separately and jointly predicted academic achievement.

Consequently, educators need to spend time in developing students' belief and internal academic tendencies in them to foster educational growth. The policy makers should therefore include in the educational blueprints strategies that will help students to develop goal setting skill, appropriate learning style and perception of self and time management skill as indicators of self-regulation and locus of control. The policy should



not just be a window dress blueprint. It should be proactively implemented and monitored until the expected skills are developed by the undergraduate students. Furthermore, school authority should always make sure that students are not left out in decision-making. It is hoped that this will promote their sense of self-regulation and locus of control about themselves and academic activities. They should endeavor to improve gender-friendly academic self-regulation and locus of control of the students by adopting teaching strategies that should stimulate them to enhance achievement in Physics.

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